Complete Summary

GUIDELINE TITLE

Evidence based clinical practice guideline for managing an acute exacerbation of asthma.

BIBLIOGRAPHIC SOURCE(S)

Cincinnati Children's Hospital Medical Center. Managing an acute exacerbation of asthma. Cincinnati (OH): Cincinnati Children's Hospital Medical Center; 2002 Sep 3. 21 p. [130 references]

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Cincinnati Children's Hospital Medical Center. 1998-1999 evidence-based clinical practice guideline for managing an acute exacerbation of asthma. Cincinnati (OH): Children's Hospital Medical Center (CHMC); 1999. 12 p.

** REGULATORY ALERT **

FDA WARNING/REGULATORY ALERT

Note from the National Guideline Clearinghouse: This guideline references a drug(s) for which important revised regulatory information has been released.

On April 7, 2005, after concluding that the overall risk versus benefit profile is unfavorable, the FDA requested that Pfizer, Inc voluntarily withdraw Bextra (valdecoxib) from the market. The FDA also asked manufacturers of all marketed prescription nonsteroidal anti-inflammatory drugs (NSAIDs), including Celebrex (celecoxib), a COX-2 selective NSAID, to revise the labeling (package insert) for their products to include a boxed warning and a Medication Guide. Finally, FDA asked manufacturers of non-prescription (over the counter [OTC]) NSAIDs to revise their labeling to include more specific information about the potential gastrointestinal (GI) and cardiovascular (CV) risks, and information to assist consumers in the safe use of the drug. See the FDA Web site for more information.

Subsequently, on June 15, 2005, the FDA requested that sponsors of all non-steroidal anti-inflammatory drugs (NSAID) make labeling changes to their products. FDA recommended proposed labeling for both the prescription and over-the-counter (OTC) NSAIDs and a medication guide for the entire class of prescription products. All sponsors of marketed prescription NSAIDs, including Celebrex (celecoxib), a COX-2 selective NSAID, have been asked to revise the

labeling (package insert) for their products to include a boxed warning, highlighting the potential for increased risk of cardiovascular (CV) events and the well described, serious, potential life-threatening gastrointestinal (GI) bleeding associated with their use. FDA regulation 21CFR 208 requires a Medication Guide to be provided with each prescription that is dispensed for products that FDA determines pose a serious and significant public health concern. See the FDA Web site for more information.

Additional Notice

On November 18, 2005, the U.S. Food and Drug Administration (FDA) notified manufacturers of Advair Diskus, Foradil Aerolizer, and Serevent Diskus to update their existing product labels with new warnings and a Medication Guide for patients to alert health care professionals and patients that these medicines may increase the chance of severe asthma episodes, and death when those episodes occur. All of these products contain long-acting beta2-adrenergic agonists (LABA). Even though LABAs decrease the frequency of asthma episodes, these medicines may make asthma episodes more severe when they occur. A Medication Guide with information about these risks will be given to patients when a prescription for a LABA is filled or refilled. See the FDA Web site for more information.

COMPLETE SUMMARY CONTENT

SCOPE

DISEASE/CONDITION(S)

Acute exacerbation of asthma

GUIDELINE CATEGORY

Diagnosis
Evaluation
Management
Treatment

CLINICAL SPECIALTY

Allergy and Immunology
Emergency Medicine
Family Practice
Pediatrics
Pulmonary Medicine

INTENDED USERS

Advanced Practice Nurses
Nurses
Patients
Physician Assistants
Physicians
Respiratory Care Practitioners

GUIDELINE OBJECTIVE(S)

- To reduce hospital admissions
- To improve short-term functional outcomes
- To maintain family satisfaction
- To decrease the use of unnecessary therapies

TARGET POPULATION

Children age 0-18 years requiring treatment for an acute exacerbation of asthma

These guidelines are not intended for use in children likely to be admitted to the intensive care unit (ICU), to require intubation, to require ventilator support or who are in severe respiratory distress; nor are they intended for management of bronchiolitis or conditions characterized by non-bronchodilator-responsive wheezing. Caution should be exercised in managing children with comorbid conditions such as: congenital or acquired cardiovascular disease, cystic fibrosis, chronic lung disease, bronchopulmonary dysplasia, or immunodeficiency syndromes.

INTERVENTIONS AND PRACTICES CONSIDERED

Diagnosis/Assessment

1. Focused medical history including time of onset of current exacerbation, current medications and allergies, recent frequent use of $beta_2$-agonists, risk factors for severe, uncontrolled disease such as emergency department visits, admissions to the hospital and intensive care units (ICUs), and prior intubations
2. Focused physical examination including vital signs, and assessment of anxiety, level of consciousness, breathlessness, wheezing or absence of air movement, respiratory rate, and accessory muscle use or supra-sternal retractions suggestive of respiratory distress
3. Pulmonary function testing including pulse oximetry and peak flow measurement
4. Detailed medical history and physical examination after therapy has begun

5. Classification of severity of asthma exacerbation as mild, moderate, severe or imminent respiratory arrest
6. Frequent and repeated clinical assessment of response to therapy

Treatment/Management (see "Major Recommendations" field for indications, purpose, and regimens)

Initial

1. Oxygen
2. Short-acting inhaled beta$_2$-agonists (albuterol, levalbuterol)
3. Early treatment with oral corticosteroids (prednisone, prednisolone, methylprednisolone)
4. Consider the use of anticholinergics such as ipratropium for moderate/severe exacerbations; magnesium sulfate treatment selectively

Inpatient

1. Aerosolized bronchodilators, oxygen, corticosteroids, initiation and continuation of controller (anti-inflammatory) agents
2. Weaning of oxygen and inhalation therapy based on symptom scoring
3. Consultations
    - Medical (pulmonary or specialists in childhood asthma)
    - Certified asthma educator
    - Social services
4. Discharge preparation including patient/family education regarding medication use and when to seek care, transition planning and follow-up

Note: Therapies not generally recommended include:

1. Theophylline or aminophylline (in hospitalized patients)
2. Chest physical therapy, incentive spirometry, and mucolytics
3. Anxiolytic and hypnotic drugs
4. Antibiotics
5. Aggressive hydration

MAJOR OUTCOMES CONSIDERED

- Symptoms (e.g., breathlessness, alertness)
- Signs (e.g., respiratory rate, pulse per minute, wheeze, accessory muscles and retraction, pulsus paradoxus)
- Pulmonary function (e.g., arterial oxygen saturation [SaO_2], arterial oxygen tension [PaO_2], arterial carbon dioxide tension [PCO_2], forced expiratory volume in 1 second [FEV_1] or peak expiratory flow [PEF])
- Time to discharge after discharge criteria are met
- Time to recovery of asthma symptoms
- Relapse rate
- Number of hospital admissions meeting admission criteria
- Medication side effects

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

The guideline developers performed an extensive literature search using a range of keywords. The National Library of Medicine's Medline database, EmBase, and the Cochrane databases were searched.

NUMBER OF SOURCE DOCUMENTS

1290 abstracts reviewed, including 430 articles reviewed, including 130 citations

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Not stated

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not applicable

METHODS USED TO ANALYZE THE EVIDENCE

Review
Review of Published Meta-Analyses

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Not stated

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

The recommendations contained in this document were formulated by a working group including community and hospital based physicians, nurses, and pharmacists, who examined current local clinical practices and performed extensive and critical literature reviews.

During formulation of these guidelines, the committee members have remained cognizant of controversies and disagreements over the management of these patients. They have tried to resolve controversial issues where possible and, when

not possible, to offer optional approaches to care in the form of information that includes best supporting evidence of efficacy for alternative choices.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

The guidelines have been reviewed and approved by clinical experts not involved in the development process, senior management, Risk Management & Corporate Compliance, the Institutional Review Board, other appropriate hospital committees, and other individuals as appropriate to their intended purposes.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Each recommendation is followed by evidence grades (A-X) identifying the type of supporting evidence. Definitions of the evidence grades are presented at the end of the Major Recommendations field.

Assessing Severity of Exacerbation

Asthma is a clinical diagnosis characterized by episodes of cough, wheezing, and dyspnea which is reversible with bronchodilator treatment.

1. Before and as therapy is initiated, obtain a brief, focused history and physical examination. Important historical elements initially are time of onset of current exacerbation, current medications and allergies, recent frequent use of $beta_2$-agonists, risk factors for severe, uncontrolled disease such as emergency department visits, admissions to the hospital and intensive care units (ICUs), and prior intubations. In addition to vital signs, physical examination findings such as anxiety, level of consciousness, breathlessness, wheezing or absence of air movement, respiratory rate, and accessory muscle use or supra-sternal retractions suggest more severe respiratory distress. Perform a more detailed assessment only after therapy has begun.
2. It is recommended that frequent and repeated clinical assessment of response to therapy (with clinical examination, assessment of response by peak flow, and pulse oximetry) be conducted in managing acute asthma

exacerbations. (National Heart, Lung and Blood Institute [NHLBI], 1997 [S]; Local Expert Consensus [E]).

3. It is recommended that peak flow monitoring be assessed historically in all patients and attempted in children over 6-8 years with mild to moderate exacerbations. (NAEPP, 2002 [S]; NHLBI, 1997 [S]; Local Expert Consensus [E])
    - Note 1: Peak flow measurement can be useful in assessing the severity of an asthma exacerbation and is most useful in patients with moderate to severe persistent asthma. It can be used in short-term monitoring, acute exacerbations, and daily chronic monitoring. (Kuntz et al., 2002 [M]; Goldberg et al., 2001 [D]; Brand et al., 1999 [D]; Kamps & Brand, 2001 [S]; NHLBI, 1997 [S]; Halterman et al., 2002 [O]). It requires learned techniques and consistent monitoring over time. It is difficult for children less than 6-8 years of age and is most useful when periodically correlated with more formal and sensitive pulmonary function testing such as spirometry.
    - Note 2: Persons taking and interpreting a patient history should be aware that patient and parental reports of medication use, peak flow values and/or environmental irritant/allergen exposure often present a more favorable description of disease management than actual behavior. (Kamps, Roorda, & Brand, 2001 [B]; Bender et al., 2000 [C]; Rich et al., 2000 [O]).

Initial Treatment

1. Oxygen - Adequate arterial oxygen levels are patient-specific and usually achieved when the oxygen saturation is above 90-94%. Therefore, starting supplemental oxygen when the saturation is consistently less than 91% and weaning oxygen when higher than 94% is recommended. (Wright et al., 1997 [D]; Geelhoed, Landau, & Le Souef, 1994 [D]; NHLBI, 1997 [S]; Local Expert Consensus [E]).
2. Short-acting inhaled $beta_2$-agonists - Administer inhaled albuterol for rapid reversal of airflow obstruction. Three albuterol treatments every 20 minutes can be given safely as initial therapy. (NHLBI, 1997 [S]; Local Expert Consensus [E]) (See the original guideline document for summary of recommended doses and comments on delivery devices). Modify the intensity of therapy and clinical assessment based on the early clinical response to therapy.
    - Note 1: In children >1 year of age with acute asthma exacerbations, there is no significant difference for important clinical responses such as time to recovery of asthma symptoms, repeat visits, or hospital admissions when medications are delivered via metered dose inhaler (MDI) (with age appropriate spacer device) or nebulizer. (Cates & Rowe, 2000 [M])
    - Note 2: MDIs have been shown to shorten time to discharge from the emergency department, to improve pulmonary function measures, and to result in lower pulse rates. Most studies included in the meta-analysis have utilized up to 4-8 puffs of an MDI and age-appropriate spacer devices. (Cates & Rowe, 2000 [M])
    - Note 3: Children aged 2-4 years have about half the rate of lung deposition of medication (5.4%) than children aged 5-8 years (9.6-11.1%), suggesting that dosing based upon body weight is not

appropriate. Drug delivery to the distal airways by conventional nebulizers and MDIs has been shown to be low in spite of the proven efficacy of these agents. (Zar et al., 2000 [B]; Wildhaber et al., 1999 [B])

- Note 4: The inhalational route for $beta_2$-agonist administration is considered optimal. Subcutaneous and intravenous routes should be reserved for severe or unusual clinical situations. Subcutaneous $beta_2$-agonists (epinephrine, terbutaline) provide no proven advantage over inhaled medication and are recommended only for selected patients who are responding poorly to or unable to tolerate aerosol treatments. (NHLBI, 1997 [S]). Intravenous beta2-agonists have not been shown to improve pulmonary physiology or outcomes compared to inhaled routes. (Travers et al., 2001 [M]; Browne, Trieu, & Van Asperen, 2002 [B])
- Note 5: Levalbuterol has been shown to have reduced side effects (on heart rate, blood pressure, serum potassium and glucose) compared to racemic albuterol, with comparable efficacy. Due to cost and lack of improved efficacy, its use may be best limited to children at risk for cardiac and/or metabolic complications. (Milgrom et al., 2001 [A]; Nelson et al., 1998 [A])

3. Corticosteroids - Early treatment with oral corticosteroids is recommended for children presenting to emergency departments who fail to respond promptly and completely to an inhaled $beta_2$-agonist (See the original guideline document for summary of recommended doses). (Rowe, Keller, & Oxman, 1992 [M]; NHLBI, 1997 [S])
    - Note 1: In asthmatic children presenting to emergency departments, an initial dose of oral corticosteroids (0.5 - 2.0 mg/kg prednisone, maximum 60 mg) has been shown to result in a 70% reduction in the risk of hospitalization, compared to children receiving only inhaled steroids (Rowe et al., 2001 [M]; Rowe, Keller, & Oxman, 1992 [M]; Qureshi, Zaritsky, & Poirier, 2001 [A]; Schuh et al., 2000 [A]; Langton Hewer et al., 1998 [B]). Dosages in excess of 1 mg/kg of prednisone or prednisolone have been associated with adverse behavioral effects in children. (Kayani & Shannon, 2002 [B]).
    - Note 2: Systemic steroids have been shown to be of particular benefit (oral, intravenous or intramuscular) in preventing relapse and repeat visits after acute exacerbations for up to 3 weeks afterwards. (Rowe et al., 2001 [M]).
    - Note 3: In known asthmatics, early initiation of inhaled steroids is important in reducing the severity and duration of the exacerbation. (Simons, 1997 [A]; NAEPP, 2002 [S]; NHLBI, 1997 [S]; Local Expert Consensus [E]). Currently there is insufficient evidence to recommend inhaled steroids ALONE in the treatment of acute exacerbations (compared to other routes with more rapid onsets of action and increased effectiveness such as oral or intravenous). (Edmonds et al., 2002 [M]; Edmonds et al., 2001 [M]).
    - Note 4: In children presenting with acute exacerbations who are already on oral steroids, the addition of inhaled steroids showed a trend toward decreased admissions that approached statistical significance. These patients also showed significant improvements in peak flows and forced expiratory volume (FEV_1) measures compared to placebo. (Edmonds et al., 2002 [M]; Edmonds et al., 2001 [M]; Edmonds et al., 2000 [M], Manjra et al., 2000 [A]).

- Note 5: It is recognized that many children will have problems with compliance due to an oral aversion to medicine, especially bitter-tasting corticosteroid preparations. In such cases, other effective alternatives such as inhaled corticosteroids, intramuscularly administered dexamethasone, oral dexamethasone, and orally administered intravenous versions of corticosteroids have been proven efficacious. (Edmonds et al., 2002 [M]; Edmonds et al., 2001 [M]; Qureshi, Zaritsky, & Poirier, 2001 [A]; Rowe et al., 1999 [A]; Gries et al., 2000 [C]; Local Expert Consensus [E]).

4. Inhaled ipratropium bromide - It is recommended that inhaled ipratropium be added to beta$_2$-agonist and corticosteroid therapies for children presenting in the emergency department or clinics with moderate to severe acute exacerbations. Dosing recommendation is 0.5 mg with each of the second and third doses of albuterol (20 and 40 minutes after initial albuterol dose). (Qureshi et al., 1998 [A]; Local Expert Consensus [E]). About 12 children will need to receive two or more ipratropium nebulized treatments to prevent one hospitalization (number needed to treat [NNT] = 12). (Plotnick & Ducharme, 2000 [M]; Osmond & Klassen, 1995 [M]; Qureshi et al., 1998 [A]; Qureshi, Zaritsky, & Lakkis, 1997 [A]; Schuh et al., 1995 [A]; Storr & Lenney, 1986 [A]; Reisman et al., 1988 [B]; Rayner, Cartlidge, & Upton, 1987 [B]).
    - Note: Although ipratropium has been shown to be efficacious in preventing hospitalizations for children with moderate-to-severe exacerbations, it has not been shown to reduce length of stay or admissions to the ICU and is therefore not a standard therapy to be considered in the inpatient management of acute exacerbations. (Craven et al., 2001 [A]; Goggin, Macarthur, & Parkin, 2001 [B]).
5. Magnesium sulfate - Consider magnesium sulfate treatment in children with more severe exacerbations. Intravenous magnesium sulfate has been shown to reduce hospitalizations in patients under treatment for acute exacerbations who have been maximized on standard therapy outlined in this guideline. (Alter, Koepsell, & Hilty, 2000 [M]; Rowe et al., 2000 [M]; Rowe et al., 2000 [M]). None of the four pediatric trials examining magnesium revealed significant side effects, such as hypotension, hypotonia, or abnormal reflexes, with dosages of 25-75 mg/kg (maximum dose 2.5 g) in children given intravenously over 20 minutes. (Ciarallo, Brousseau, & Reinert, 2000 [B]; Scarfone et al., 2000 [B]; Devi et al., 1997 [B]; Ciarallo, Sauer, & Shannon, 1996 [B]).

Inpatient Management

1. Therapy - The principles of care in the hospital are similar to those for care in the emergency department. (NHLBI, 1997 [S]). It is recommended that, excluding the use of anticholinergics, hospital management be viewed as a continuation of any therapies already initiated. Usual inpatient therapies include: aerosolized bronchodilators, oxygen, corticosteroids, initiation and continuation of controller (anti-inflammatory) agents. It is recommended that the Cincinnati Children's Hospital Medical Center (CCHMC) Asthma Aerosol and Oxygen Protocols for automatic weaning of oxygen and inhalation therapies be ordered for all patients admitted to a hospital bed. Use of a clinical pathway for inpatient management has been shown to decrease length of stay, use of beta$_2$-agonist therapy, nursing and laboratory costs, and to improve quality of care with no increase in readmission rates.

(Johnson, Blaisdell, & Walker, 2000 [A]; Wazeka et al., 2001 [D]; Kelly et al., 2000 [D]).

2. Consultations - Consider the need for consultation at the time of admission, or as early as possible in the hospital course.
    - Usual indications for considering medical consultation from the Hospital based Allergy/Pulmonary Asthma Service or from community specialists in childhood asthma (NHLBI; 1997 [S]).
        - Cases where the diagnosis of asthma is in question.
        - Patients with a life-threatening asthma exacerbation.
        - Patients with repeated hospital admissions, history of an intensive care admission, frequent emergency department visits for asthma, or a history of a need for multiple or frequent drug therapies at home.
        - Other conditions complicating asthma or its diagnosis (e.g., sinusitis, nasal polyps, aspergillosis, severe rhinitis, vocal cord dysfunction, gastroesophageal reflux, and chronic obstructive pulmonary disease).
        - Patient requires extensive education and guidance on allergen avoidance, problems with adherence to therapy, or complications of therapy.
    - Indication for Certified Asthma Educator resources for a patient/family education consult:
        - For patients encountered on hospital units requiring special resources for asthma education
    - Indication for requesting a social services consultation:
        - Consider especially when the family resources are compromised or uncertain; also when a family's social or financial difficulties might be impediments to compliance with the asthmatic child's treatments and medical follow-up.

Other Therapy Considerations

Harm

1. In asthmatic children who are managed with chronic oral or inhaled steroids it is important to monitor growth and local side effects.
    - Note 1: Several studies and a systematic review have documented a decrease in growth velocity associated with the use of inhaled corticosteroid medicines in the first year of treatment. (Sharek & Bergman, 2000 [M]; Lipworth, 1999 [M]; de Benedictis et al., 2001 [A]; Childhood Asthma Management Program Research Group, 2000 [A]; Agertoft & Pedersen, 2000 [C]; Price et al., 2002 [S]; Creese & Doull, 2001 [S]; MacKenzie, 1998 [S]). One large, prospective randomized controlled trial (RCT) of budesonide followed children for four to six years and showed little effect on growth rate beyond the first year and in final adult height. (Childhood Asthma Management Program Research Group, 2000 [A]).
    - Note 2: The effects on growth velocity and other local side effects appear to be greater with the use of beclomethasone diproprionate compared to newer agents. (Sharek & Bergman, 2000 [M]; Rao et al., 1999 [B]; Dubus et al., 2001 [C]).

- Note 3: There are possible adverse behavioral side effects to higher dosages (>1 mg/kg) of oral steroids that should be considered in the management of children with acute exacerbations. (Kayani & Shannon, 2002 [B]).

2. There is no evidence for harmful effects of ibuprofen compared to acetaminophen used in the majority of children with asthma who do not have known aspirin sensitivity. Ibuprofen may be a better choice for the treatment of fever/pain in children presenting with acute asthma exacerbations. In children presenting with asthma exacerbations and fever, there is evidence from one large (n=1879) RCT that ibuprofen (dose 5-10 mg/kg) reduced the risk of a future outpatient visit for asthma by 44% (95% CI 5, 66). In this RCT, 33 asthmatic children needed to be exposed to ibuprofen to prevent 1 outpatient visit for asthma (NNT=33). (Lesko et al., 2002 [A])

Therapies Not Generally Recommended

1. Neither theophylline nor aminophylline are routinely used in hospitalized patients because they have not been shown to add significant bronchodilator benefit to aerosolized beta$_2$-agonists and may produce adverse effects. (Strauss et al., 1994 [B]; Carter et al., 1993 [B]; DiGiulio et al., 1993 [B]).
    - Note 1: Patients using theophylline as outpatients may continue on their usual doses in the hospital. Assessing therapeutic levels in hospitalized children should be considered. (NAEPP, 2002 [S]).
    - Note 2: In patients with severe exacerbations who have been maximized on therapies of proven efficacy outlined in this guideline (oxygen, beta$_2$-agonist, corticosteroids, ipratropium), aminophylline has been shown in one meta-analysis to improve pulmonary function with no effect on length of stay or bronchodilator use. (Mitra, Bassler, & Ducharme, 2001 [M]).
2. Chest physical therapy, incentive spirometry, and mucolytics can trigger bronchospasm and, specifically, are not recommended during an acute asthma attack (NHLBI, 1997 [S]).
3. Anxiolytic and hypnotic drugs can cause respiratory depression and are not recommended for use outside of an intensive care setting (NHLBI, 1997 [S]).
4. Antibiotics are not recommended for acute asthma exacerbations in the absence of an identified bacterial focus--see National Guideline Clearinghouse (NGC) summary of the Cincinnati Children's Hospital Medical Center (CCHMC) Evidence Based Clinical Practice Guideline: Evidence Based Clinical Practice Guideline for Medical Management of Otitis Media in Children 2 Months to 6 Years of Age; Evidence Based Clinical Practice Guideline for Children with Acute Bacterial Sinusitis in Children 1 to 18 Years of Age. (Graham, Lasserson, & Rowe, 2001 [M]; NAEPP, 2002 [S]).
5. In the absence of clinical dehydration, aggressive hydration is not recommended. (NHLBI, 1997 [S]).

Discharge Preparation

1. Education

   Prior to discharge it is recommended that the patient undergo classification of severity of chronic asthma (see Attachment 4 in original guideline document).

This will support a patient-centered approach to therapy (NHLBI, 1997 [S]; Local Expert Consensus [E]).

Education about the etiology, prognosis, and risk factors for asthma and prevention of acute exacerbations is recommended (NHLBI, 1997 [S]).

Attempts to address parental and/or patient knowledge of and attitudes toward asthma and its management are important in improving compliance with care plans. Parental attitudes toward asthma and their knowledge of its pathophysiology, medications, action plans, and environmental triggers influenced adherence to prescribed asthma medicines and action plans in several studies. (Jones et al., 2002 [D]; Sherman et al., 2001 [D]; NHLBI, 1997 [S]; Douglass et al., 2002 [O]; Mansour, Lanphear, & DeWitt, 2000 [O]).

It is recommended that a discussion of early clinical signs and symptoms of airway inflammation, prescribed medications, and their timing and correct use be held with patients and their families prior to discharge from the office, emergency department, or hospital. (NHLBI, 1997 [S]; Local Expert Consensus [E]).

- Note 1: It has been shown that compliance with prescriptions to be filled after discharge from the emergency department is reduced compared to medicines dispensed directly to the patient prior to discharge. (Qureshi, Zaritsky, & Poirier, 2001 [A]; Cooper & Hickson, 2001 [D]; Warman, Jacobs, & Silver, 2002 [O]).
- Note 2: Peak flow measurement can be useful in assessing the severity of an asthma exacerbation and is most useful in patients with moderate to severe persistent asthma. It can be used in short-term monitoring, acute exacerbations, and daily chronic monitoring. (Kuntz et al., 2002 [M]; Goldberg et al., 2001 [D]; Brand et al., 1999 [D]; Kamps & Brand, 2001 [S]; NHLBI, 1997 [S]; Halterman et al., 2002 [O]). It requires learned techniques and consistent monitoring over time. It is difficult for children less than 6-8 years of age and is most useful when periodically correlated with more formal and sensitive pulmonary function testing such as spirometry.
- Note 3: Asthma education plans have been successfully implemented in busy emergency departments. Patient-centered, specific education efforts may be more effective than general or poorly targeted interventions.(Toelle & Ram, 2002 [M]; Haby et al., 2001 [M]; Stevens et al., 2002 [A]; Homer et al., 2000 [A]; Irvine et al., 1999 [A]; Emond et al., 2000 [C]; Petersen et al., 1999 [C]; NAEPP, 2002 [S]; NAEPP, 1997 [S]; NHLBI, 1997 [S]; Forbis & Aligne, 2002 [O]).
- Note 4: Disparities in quality of care have been shown to be present under a variety of conditions. (Lara et al., 2002 [E]). It is recommended that caregivers provide patient-centered, equitable care by giving special consideration to these conditions.
    - Among Medicaid-covered children, black and Latino children had worse asthma status (parental report) and were less likely to be using preventive, anti-inflammatory agents than white children. (Lieu et al., 2002 [D]).

- Children who were uninsured or on Medicaid ranked significantly lower on seven quality measures including emergency department utilization, prescriptions from the emergency department, and access to and use of a primary care provider (Ferris et al., 2001 [O]).
- The effect of comorbid conditions and mental illness in mothers of asthmatic children has recently been shown to impact asthma control and health services utilization related to asthma (Coughlan, Gibson, & Henry, 2001 [M]; Bartlett et al., 2001 [C]; Belamarich et al., 2000 [C]; Rodriguez et al., 2002 [O]; Shalowitz et al., 2001 [O]).

2. Transition Planning

Although this guideline is focused on the acute management of asthma exacerbations, it is recognized that asthma is a chronic disease. The following recommendations are intended to assist the transition from the acute exacerbation to more chronic management. Recommendations for comprehensive management of chronic asthma can be found in the National Heart, Lung and Blood Institute (NHLBI) asthma guideline and its recent update (NAEPP, 2002 [S]; NHLBI, 1997 [S]).

1. It is recommended that beta$_2$-agonists be used at home on an as-needed basis after recovery from an acute asthma exacerbation ($FEV_1 \geq 80\%$ predicted or PEF returned to baseline). There is no advantage to scheduled beta$_2$-agonist therapy compared to as-needed dosing. (Walters & Walters, 2000 [M]; Local Expert Consensus [E]).
2. It is recommended that follow-up with the primary care physician occur 3-5 days after a visit for an acute exacerbation. (Walters & Walters, 2000 [M]; Local Expert Consensus [E]).
3. In order to tailor patient-centered, chronic asthma management, it is recommended that patients being discharged after acute exacerbations have a plan which includes a stepwise approach to asthma control with an emphasis on appropriate inhaled corticosteroid therapy (see Attachment 5 in original guideline document). (NAEPP, 2002 [S]; NHLBI, 1997 [S]).
    - Note 1: Prevention of acute exacerbations includes improvement of poor asthma control (as measured by pulmonary function [PEF] or symptomatology) and education about risk factors such as allergens and irritants found in the child's environment. Specifically, under appropriate clinical circumstances, assessment of the home environment for cockroach or dust mite allergen, pets, environmental tobacco smoke, stove emissions and other pollutants may identify interventions to reduce allergic and irritant exacerbations. (Chan-Yeung et al., 2002 [A]; Custovic et al., 2001 [A]; Chan-Yeung et al., 2000 [A]; Finn et al., 2000 [C]; Mahabee-Gittens, 2002 [D]; NHLBI, 1997 [S]; Friedman et al., 2001 [O]; Lanphear & Aligne et al., 2001 [O]; Lanphear & Kahn et al., 2001 [O]; Nelson et al., 1999 [O]). Almost half (44%) of the 4.6 million annual cases of doctor-diagnosed asthma have been shown to be related to residential exposures. (Lanphear & Aligne et al., 2001 [O]; Lanphear & Kahn et al., 2001 [O]).

However, the results of home environmental modification, such as allergen covers, cleaning, and dusting, have been mixed as regards asthma prevention or control. (Gotzsche et al., 2001 [M]; Gergen et al., 1999 [A]; Popplewell et al., 2000 [B]). Studies on family education to reduce environmental tobacco smoke (ETS) exposure have had mixed results. (Wahlgren et al., 1997 [B]).

- Note 2: Primary prevention of asthma in infants and children with a family history of asthma should be reviewed with the patient and family. Risk factors to be considered include exposure to dust mites, tobacco smoke, cockroach antigen and industrial pollution. (Rhodes et al., 2002 [C]; Litonjua et al., 2001 [C]; Infante-Rivard et al., 1999 [C]; Kim et al., 2001 [O]; Larsson et al., 2001 [O]). Protective factors include participation in day care and older siblings in the home. (Infante-Rivard et al., 2001 [C]; Lister et al., 2001 [C]; Ball et al., 2000 [C]). Early wheezing does not necessarily predispose to the development of childhood asthma in most cases and anti-inflammatory treatment of hospitalized infants with bronchiolitis does not seem to protect against future development of asthma. (Rhodes et al., 2002 [C]; Lau et al., 2000 [C]; Martinez et al., 1995 [C]).

Discharge Criteria

Begin planning when the child first presents to the emergency department. Discharge planning is expected to include an educational component enhancing likelihood that the family, and ultimately the child, will become skilled in the ongoing management of what may be a lifelong disorder. Early planning is also important to assure that all follow-up plans are specified and, whenever possible, problems with the details associated with follow-up, including appointments and acquisition of necessary home care equipment, have been resolved prior to discharge.

1. Discharge readiness usually includes the following:
    - Child stable on current therapies. No specific timeframe between albuterol treatments is required.
    - Considerations include:
        - supportive and stable family home environment
        - able to comply with discharge plan
        - sufficient knowledge of asthma pathophysiology to seek care if symptoms are worsening
    - Consider discharge from emergency department or hospital if severity of exacerbation is in "mild" range (see Attachment 3 in original guideline document). (NHLBI, 1997 [S]).
    - In the emergency department, if severity is initially moderate or severe, consider observation, before discharge, for 45-60 min without nebulization. When possible and appropriate, assessing peak flow and confirming it is >60-70% of the patient's personal best is recommended.
2. Continue required therapies at home. In a stepwise approach, tailor therapies to be continued after discharge (beta$_2$-agonists, steroids, other controller

medications) to the patient's chronic asthma severity classification (see Attachment 4 in original guideline document.) (NAEPP, 2002 [S]; Local Expert Consensus [E]).
3. Follow-up plans have been finalized and arrangements made for acquiring any special medications or equipment that may be required for home therapies.
4. Transition and prevention plan are completed.
5. Follow-up care providers have been notified and agree with plans.
6. Family has participated in the planning process and family/patient education is sufficiently complete to assure that prescribed care in the immediate post-discharge period can be provided safely and competently at home.

Definitions

Evidence Based Grading Scale:

A: Randomized controlled trial: large sample
B: Randomized controlled trial: small sample
C: Prospective trial or large case series
D: Retrospective analysis
E: Expert opinion or consensus
F: Basic laboratory research
S: Review article
M: Meta-analysis
Q: Decision analysis
L: Legal requirement
O: Other evidence
X: No evidence

CLINICAL ALGORITHM(S)

An algorithm is provided for care of acute exacerbation.

EVIDENCE SUPPORTING THE RECOMMENDATIONS

REFERENCES SUPPORTING THE RECOMMENDATIONS

References open in a new window

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of evidence is identified and graded for each recommendation (see "Major Recommendations") using the following scheme:

Evidence Based Grading Scale:

A: Randomized controlled trial: large sample
B: Randomized controlled trial: small sample
C: Prospective trial or large case series
D: Retrospective analysis
E: Expert opinion or consensus
F: Basic laboratory research

S: Review article
M: Meta-analysis
Q: Decision analysis
L: Legal requirement
O: Other evidence
X: No evidence

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Appropriate medical treatment and management of acute asthma exacerbations in children as demonstrated by:

- Reduced hospital admissions
- Improved short-term functional outcomes
- Improved patient/family satisfaction with treatment
- Decreased use of unnecessary therapies

POTENTIAL HARMS

Medication reactions and side-effects:

In asthmatic children who are managed with chronic oral or inhaled steroids it is important to monitor growth and local side effects.

- Note 1: Several studies and a systematic review have documented a decrease in growth velocity associated with the use of inhaled corticosteroid medicines in the first year of treatment.
- Note 2: The effects on growth velocity and other local side effects appear to be greater with the use of beclomethasone diproprionate compared to newer agents.
- Note 3: There are possible adverse behavioral side effects to higher dosages (>1 mg/kg) of oral steroids that should be considered in the management of children with acute exacerbations.

Subgroups Most Likely to be Harmed:

Asthmatic children who are managed with chronic oral or inhaled steroids

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

- These guidelines are a set of recommendations resulting from review of literature and practices current at the time of their formulations. This protocol does not preclude using care modalities proven efficacious in studies published subsequent to the current revision of this document. The guideline document is not intended to impose standards of care preventing selective variances from the guidelines to meet the specific and unique requirements of

individual patients. Adherence to this pathway is voluntary. The ultimate judgment regarding the priority of any specific procedure must be made by the physician in light of the individual circumstances presented by the patient.

- These guidelines are not intended for use in children likely to be admitted to the intensive care unit (ICU), to require intubation, to require ventilator support or who are in severe respiratory distress. Nor are they intended for management of bronchiolitis or conditions characterized by non-bronchodilator-responsive wheezing. Caution should be exercised in managing children with comorbid conditions such as: congenital or acquired cardiovascular disease, cystic fibrosis, chronic lung disease or bronchopulmonary dysplasia, and immunodeficiency syndromes.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

The implementation process for each Cincinnati Children's Hospital Medical Center (CCHMC) guideline is a phase in a larger process of Guideline Development. This process is utilized for every guideline but is not addressed in the content of every guideline.

At the start of each guideline, a projected implementation date is determined. Reservations for education are then made (Grand Rounds, Patient Services Inservices). When the guideline is complete and enters into the Approval Process, Education planning begins. Changes created by the guideline are outlined as well as anticipated outcomes. The implementation date is confirmed. Education is provided. The guideline is implemented and pilot information collection started. The Guideline Coordinator makes daily rounds and eligible children are followed to document the use of the guideline. The implementation phase aids in finding areas for improvement or question. When issues identified are improved the guideline progresses to the monitoring phase.

IMPLEMENTATION TOOLS

Chart Documentation/Checklists/Forms
Clinical Algorithm

For information about availability, see the "Availability of Companion Documents" and "Patient Resources" fields below.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better
Living with Illness

IOM DOMAIN

Effectiveness
Patient-centeredness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Cincinnati Children's Hospital Medical Center. Managing an acute exacerbation of asthma. Cincinnati (OH): Cincinnati Children's Hospital Medical Center; 2002 Sep 3. 21 p. [130 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

1998 Jul 20 (revised 2002 Sep 3)

GUIDELINE DEVELOPER(S)

Cincinnati Children's Hospital Medical Center - Hospital/Medical Center

SOURCE(S) OF FUNDING

Cincinnati Children's Hospital Medical Center

GUIDELINE COMMITTEE

Evidence-Based Clinical Practice Guideline Asthma Revision Team

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FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: Cincinnati Children's Hospital Medical Center. 1998-1999 evidence-based clinical practice guideline for managing an acute exacerbation of asthma. Cincinnati (OH): Children's Hospital Medical Center (CHMC); 1999. 12 p.

GUIDELINE AVAILABILITY

Electronic copies: Available from the Cincinnati Children's Hospital Medical Center.

For information regarding the full-text guideline, print copies, or evidence-based practice support services contact the Children's Hospital Medical Center Health Policy and Clinical Effectiveness Department at HPCEInfo@chmcc.org.

AVAILABILITY OF COMPANION DOCUMENTS

The following are available:

- Clinical guideline admission orders.

- Clinical pathway.
- Discharge instructions.
- Education record.
- Level of care segmentation.
- Respiratory assessment/care record.
- Asthma aerosol and oxygen protocols.

For information contact the Children's Hospital Medical Center Health Policy and Clinical Effectiveness Department at HPCEInfo@chmcc.org.

PATIENT RESOURCES

The following are available:

- Asthma. Cincinnati (OH): Cincinnati Children's Hospital Medical Center, 2002 Oct. 4 p. Electronic copies of this and other related materials are available from the Cincinnati Children's Hospital Medical Center (CCHMC) Web site.
- Metered dose inhaler. Cincinnati (OH): Cincinnati Children's Hospital Medical Center, 2002 Oct. 2 p. Electronic copies of this and other related materials are available from the CCHMC Web site.
- Reducing asthma triggers in your home. Cincinnati (OH): Cincinnati Children's Hospital Medical Center, 2002 Oct. 2 p. Electronic copies of this and other related materials are available from the CCHMC Web site.

Please note: This patient information is intended to provide health professionals with information to share with their patients to help them better understand their health and their diagnosed disorders. By providing access to this patient information, it is not the intention of NGC to provide specific medical advice for particular patients. Rather we urge patients and their representatives to review this material and then to consult with a licensed health professional for evaluation of treatment options suitable for them as well as for diagnosis and answers to their personal medical questions. This patient information has been derived and prepared from a guideline for health care professionals included on NGC by the authors or publishers of that original guideline. The patient information is not reviewed by NGC to establish whether or not it accurately reflects the original guideline's content.

NGC STATUS

This summary was completed by ECRI on September 20, 1999. The information was verified by the guideline developer on November 15, 1999. This summary was updated by ECRI on November 26, 2002. The information was verified by the guideline developer on December 24, 2002. This summary was updated on May 3, 2005 following the withdrawal of Bextra (valdecoxib) from the market and the release of heightened warnings for Celebrex (celecoxib) and other nonselective nonsteroidal anti-inflammatory drugs (NSAIDs). This summary was updated by ECRI on June 16, 2005, following the U.S. Food and Drug Administration advisory on COX-2 selective and non-selective non-steroidal anti-inflammatory drugs (NSAIDs). This summary was updated by ECRI on December 5, 2005 following the U.S. Food and Drug Administration (FDA) advisory on long-acting beta2-adrenergic agonists (LABA).

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